

# PATENT SPECIFICATION

DRAWINGS ATTACHED

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## COMPLETE SPECIFICATION

### Process and Apparatus for Preparation of Flavour Bases

We, PAN-CITRUS CORPORATION, a corporation organised and existing under the laws of the State of California, United States of America, of 4956, Melrose Avenue, City of Los Angeles, State of California, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an improved process and apparatus for preparing flavour bases, as hereinafter defined, from fruits including preparing flavour bases from whole citrus fruits, such as oranges, lemons, limes, tangerines and other fruits where the flavour is contained in both the peel and the juice. More particularly, this invention relates to methods and apparatus for extracting flavour from fruits in such manner as to retain the desirable aromatic flavour components and the natural pectin without the formation of bitterness or undesirable flavour.

The term "flavour base" used herein is intended to mean a concentrate or extract which is derived from a fruit and contains the flavouring components thereof in a concentrated form.

The present invention provides a continuous method for forming flavour bases, as hereinbefore defined, of fruits wherein the flavour components are initially extracted from a shredded mass of fruit by adding heated water thereto to produce an aqueous liquid containing juices from the fruit at a temperature between 90° F. and 145° F., and wherein the said liquid is continuously passed through shredded fruit, and heated water is added to said liquid if desired, until a desired concentration of flavour components in said liquid is attained.

The present invention further provides apparatus for preparing flavour bases of fruits comprising a shredder for shredding the fruit, a mechanical extractor for extracting juices

from the shredded fruit, means for diluting the juice with heated water, thereby raising the temperature of the resultant diluted juice to between 90° F. and 145° F., and means for passing the heated diluted juice, with additional heated water, if desired, through said shredded fruit.

Flavour bases are at present made and sold in concentrated form, either sweetened or unsweetened, so that they may thereafter be diluted with water to form flavoured soft drinks, such as orange drinks and lemonade.

According to the present invention, we are able to produce flavour bases in which substantially all of the flavour components are retained as are the pectins in the natural fruit. As a result, the flavour base is a truer representation of the natural flavour, and the addition of clouding agents, such as brominated oil, or thickening agents, such as gum stabilizer, is unnecessary.

Certain citrus fruit juices, e.g. the juice of navel oranges, have a tendency to become bitter after relatively short periods of storage. We have found, however, that if such juices are subjected to a heat treatment for a certain period, the production of bitter-flavour producing substances is inhibited (or such substances are removed) and such juices in concentrated or non-concentrated form may be maintained in storage for a long period without developing a bitter taste.

In accordance with one aspect of the present invention, a concentrated flavour base is prepared by mechanically masticating the fruit to break down the cellular structure, thereby forming a shredded mass of fruit, and removing the flavour components therefrom by percolating through the shredded mass heated, previously extracted juice containing flavour components. If desired, the shredded fruit may be subjected to at least two such extractions in separate stages, so as to remove substantially all of the flavour components.

By maintaining the flavour base extract so

[Price 3s. 6d.]

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Price 2s. 6d.

formed at an elevated temperature for some time after extraction, the occurrence of bitter-flavour producing substances is inhibited.

5 The accompanying drawing illustrates an exemplary embodiment of the invention and is a diagrammatic view, in the nature of a flow chart, illustrating one form of the apparatus usable in the process of the invention.

10 Referring to the drawing there is shown an apparatus for continuously producing flavour bases of fruits. For this purpose there is provided a hopper 10 having an inlet opening 11 through which fruit may be introduced into the hopper. Near the bottom of the hopper is a shredder or shredding device 12 provided with cutting blades and rotated by means of a shaft 13 driven by a suitable electric motor 14. While many forms of shredding devices may be used, we prefer the particular type shown in the U.S. Patent No. 2,086,911, wherein the whole fruit is brought into contact with a rapidly-moving shredding surface whereby the fruit is shredded in a plurality of substantially parallel planes extending transversely through the fruit, and high shredding speeds e.g. not less than 1500 feet per minute for the shredding surface are preferred.

30 From the shredder, the shredded fruit and juice drops through a tube 15 to the lower end of a first stage extractor 16. The first stage extractor includes an upwardly inclined tube forming a passage 17 having a foraminous screen 18 at its lower end overlying a conduit 19, so that juices and sufficiently fine solid particles may pass through the screen and into the conduit. Within the tube 17 there is provided a rotatable shaft 20 adapted to be driven by suitable pulleys and belts 21 connected to a driving motor 22. The shaft 20 forms part of a screw conveyor having blades 23 provided with serrated outer edges 24, so that liquid may drain downwardly in the tube.

35 Communicating with the upper end of the tube 17 is a downwardly directed tube forming a passage 25 opening at its lower end to a finisher 26. The finisher includes a generally conical screen 27 having therein a rotatably mounted spiral brush 28 arranged to be rotated so as to move fruit pulp 29 therein toward a discharge outlet 30. The finisher 26 is formed with a conical bottom 31 communicating with a pipe 32.

40 A source of steam 35 and a source of water 36 are provided, each controlled by suitable valves 37 and 38, so that the temperature of the water from the source 36 may be regulated. To assist in such regulation a thermometer 39 is provided. Heated water may thus be introduced into the pipe 47 and thence into the tube 17, so that it may percolate downwardly through the tube to the screen 18.

60 The passage 19 communicates with a pipe 40 connected to the inlet of a pump 41 driven by a motor 42. The outlet of the pump dis-

charges into a pipe 43 in turn discharging 65 into the tube 25.

A second pump 44 has its inlet connected to the pipe 32 and its outlet to a pipe 45 with the pump 44 being driven by the motor 46. The pipe 45 communicates with a storage tank 50 through the medium of a conduit section 51 controlled by a valve 52 and also with a pipe 53 controlled by a valve 54 and communicating with the pipe 47.

70 Suitable thermometers 55 and 56 are provided for observing and regulating the temperature in the lines 51 and 47, respectively.

As illustrative of the process and the use of the apparatus a preferred method of preparing orange flavour base is as follows:— 80

Oranges are fed to the hopper 10 of the apparatus at the rate of 30 pounds per minute. The steam and water valves 37 and 38 are set to introduce water into the upper end of the passage 17 at the rate of 10 pounds per minute. This results, on the average, in a pulp discharge rate from the finisher 26 of 19 pounds per minute and a discharge of liquid extract into the line 45 at the rate of 21 pounds per minute. 90

It is an important part of the invention to surround the shredded fruit with extraction medium immediately the cellular structure of the fruit is exposed—thus starting the temperature and time control of enzyme activity immediately. The continuous, counter-current type of extraction is also important to the efficiency of the extraction and control of enzyme activity. 95

The process is started up by introducing 100 hot water at the upper end of the extractor 16 in order to surround the shredded fruit with an extractant medium at the correct temperature and the entire volume of extract from the finisher is preferably circulated through the extractor 16 via line 53 until the extractor is filled with liquid. The amount of hot water can then be regulated, usually reduced, when the mixture of water and extracted juice is recirculated through the extractor. When this has been accomplished, the valve 52 controlling the line 51 to the storage tank is opened so that 21 pounds per minute of liquid extract is run into the storage tank. In normal operation the water introduced at the upper end of pipe 47 is regulated as to temperature, so as to produce an extract-water mixture temperature, entering the storage tank 50 of the order of 120° F. This temperature is essential only at the point where the juices are extracted from the shredded mass. In the example given, a water temperature of about 190° F. will accomplish this result. The temperature of the influent extraction water is dependent upon the desired temperature of final extract-water mixture. 110 115 120 125

The extract-water mixture passes downwardly through the extractor passage 17, passing by the serrated edges 24 of the

screw conveyor and picking up from the shredded fruit therein components of flavour which ultimately reach the screen 18 and conduit 19. The pump 41 then directs this mix into the line 43 for discharge into the passage 25 entering the finisher. In the finisher the mix is further screened to remove coarse particles and seed fragments and the finisher, of course, removes liquid clinging to the pulp before the latter is discharged through the outlet 30.

The liquid extract from the finisher is in part recirculated through the extraction tube 17 in order to build up flavour components concentration and the balance directed to the storage tank 50.

Another method of operating is to connect line 43 to a separate finisher to remove the coarser fragments which pass through screen 18 and send the extract from this latter finisher directly into line 32.

When dealing with fruits whose juices have a tendency to become bitter in storage, the extract level in the storage tank is maintained at a volume to allow a holding time of the extract therein sufficient to inhibit the occurrence of bitter-flavour producing substances. For most fruits, for example, navel oranges, a holding time of approximately 30 minutes (120° F.) before pasteurization and homogenization is ample. Homogenization is accomplished at approximately 1000 pounds per square inch gauge pressure and pasteurization is accomplished by heating the extract to a temperature of 205° F. with a holding time of approximately 10 seconds, followed by cooling to 40° F. in storage prior to canning.

The flavour base extract can be canned without other additions for use as a flavour base wherein the ultimate user may add sugar or water to suit tastes and needs. If desired, citric acid and sweetener may be added, for example, for a complete orange drink base, approximately 0.5 pounds anhydrous citric acid together with 17 pounds of sucrose per gallon of extract may be added to yield a flavour base which can be diluted with water to provide an orange drink or an orange sherbet. The extract, sweetened or unsweetened, may be canned by heating it to 190° F., filling it hot into cans and immediately cooling or, preferably, may be high-temperature, short-time sterilized at 210° F. for 5 seconds, cooled to 80° F. within 10 seconds and aseptically canned.

We have found that by maintaining an extract temperature of 120° F. there is a maximum extraction of desirable flavours without extraction of excessive amounts of bitter or bitter-flavour producing substances which cannot be removed by subsequently holding the extract at an elevated temperature as described. Furthermore, we have found that at 120° F. there is excellent retention of substances, such as pectins, which produce

good viscosity and body and which are permanently preserved after the pasteurization treatment. For example, at an extract temperature of 60° F. the efficiency of flavour components extraction is relatively low (without excessive recirculation) and the amount of natural orange oil in the extract is also low. Also at this temperature there is initiated rapid loss of extract viscosity which occurs during the period of extraction and the period required to homogenize and pasteurize the extract.

The amount of recirculation of extract through the extraction tube 17, where flavour components from the freshly-shredded fruit are extracted, will determine the concentration of flavour components. The concentration of flavour components will also be determined by the ratio of the amount of extraction water entering the extractor to the amount of fruit being fed. The amount of recirculation is, however, limited by the size of the equipment and the efficiency of the finisher. Also, too great a recirculation rate and volume will result in some of the extract being in circulation for an excessive time with resulting loss of viscosity of the final product. We have found that for optimum flavour from oranges it is best not to recirculate more than four volumes of extract per volume thereof removed from the system, for lemons not more than four volumes, for limes not more than two volumes, and for tangerines not more than three volumes. For fruits such as mango, where the flavour is less from the peel than from the soluble constituents of the fruit itself, it is not necessary to recirculate more than two volumes.

The ratio of extraction water to fruit is optimum at approximately one pound of water to three pounds of fruit. A much higher ratio of water produces a flavour base which is not of sufficient strength for commercial use and a much lower ratio does not provide sufficient efficiency in extraction, although if a highly concentrated flavour base is desired, the water dilution can be discontinued and only the juice recirculated. The normal operating range is approximately 1/4 pound to 2 pounds water to one pound of fruit. Limes, lemons and grapefruit can be extracted with as much as one pound water to one pound of fruit because the natural flavour intensity in these fruits is higher than in oranges.

In fruits where pectin destruction should be inhibited an extraction temperature of between 90° F. and 145° F. is required. The extract is then held at an elevated temperature after extraction for sufficient time to allow the removal of bitter-flavour-producing substances. The period between extraction and pasteurization is most critical in the case of navel oranges with 30 minutes being optimum at 120° F. Lemon and lime flavour extracts are best held at elevated temperatures for

no longer than three hours before being pasteurized to prevent the development of a "woody" flavour and are preferably held for about 30 minutes.

- 5 Although the primary purpose of the invention is to prepare citrus flavour bases, the process and apparatus can also be used for the extraction of flavour advantageously from such materials as coconut meat, mango or  
10 guava, where much extractable flavour exists in the non-juice portion.

WHAT WE CLAIM IS:—

1. A continuous method for forming flavour bases, as hereinbefore defined, of fruits  
15 wherein the flavour components are initially extracted from a shredded mass of fruit by adding heated water thereto to produce an aqueous liquid containing juices from the fruit at a temperature between 90° F. and  
20 145° F., and wherein the said liquid is continuously passed through said shredded fruit, and heated water is added to said liquid if desired, until a desired concentration of flavour components in said liquid is attained.

- 25 2. A method according to Claim 1, wherein the fruit is continuously shredded, and continually moved through an extractor stage to extract the flavour components therefrom, and wherein a portion of the resulting liquid and  
30 flavour component mix is directed to storage, and the balance of the resulting liquid and flavour component mix is directed to said extractor stage to be mixed, if desired, with the heated water supplied thereto.

- 35 3. A method according to Claim 2, for preparing orange juice in which said water is mixed with said resulting liquid and flavour component mix at a rate of from 1/4 to 2 pounds of water per pound of fruit.

- 40 4. A method according to Claim 2 or 3, in which said portion of the resulting liquid and flavour component mix is held in storage at an elevated temperature for a time sufficient to prevent the development of bitter-flavour  
45 producing substances in the mix.

5. A method according to Claim 4 in which said elevated temperature is such as to preserve the pectin in the extract.

6. A method according to Claim 4 or 5,  
50 for preparing orange juice in which said liquid and flavour component mix is held in storage for approximately 30 minutes at a temperature of the order of 120° F.

7. A method according to any of the preceding claims which comprises percolating the  
55 heated extracted juice through the shredded mass.

8. The method for preparing flavour bases of citrus fruits according to Claim 1, wherein the extraction is conducted at a temperature  
60 above 90° F. to inhibit pectin destroying enzyme action and below 145° F. to prevent the formation and retention of bitter-flavour producing substances, and then pasteurizing and canning the extract.

9. A concentrated flavour base made by the process of any of the preceding claims.

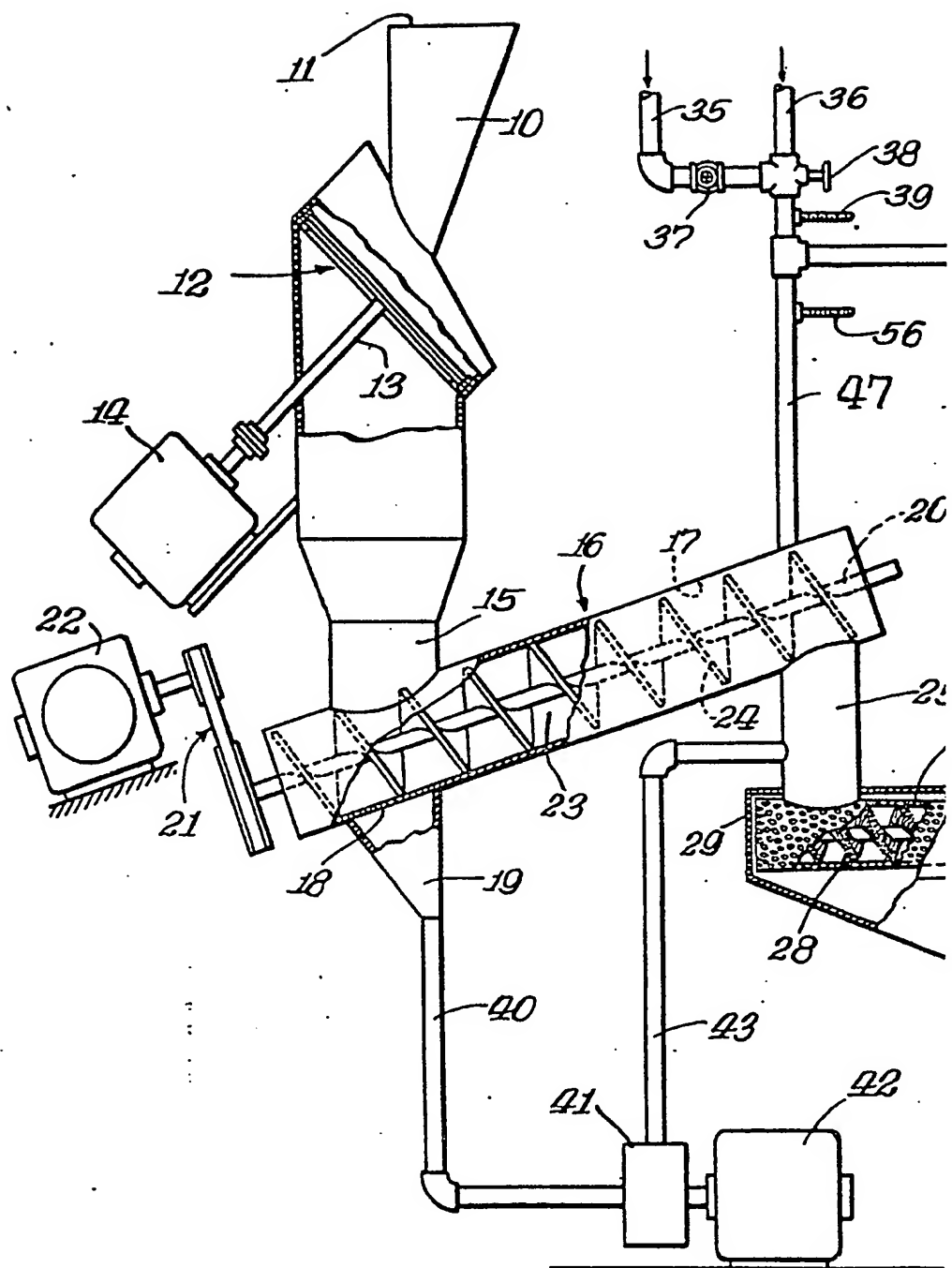
10. Apparatus for preparing flavour bases of fruits comprising a shredder for shredding the fruit, a mechanical extractor for extracting  
70 juices from the shredded fruit, means for diluting the juice with heated water, thereby raising the temperature of the resultant diluted juice to between 90° and 145° F. and means for passing the heated diluted juice, with  
75 additional heated water, if desired, through said shredded fruit.

11. An apparatus according to Claim 10, comprising a hopper, a shredding device having an inlet communicating with the hopper  
80 successively to shred fruit fed to said hopper, means forming an inclined passage, a foraminous screen at the lower portion of said passage, means for feeding shredded fruits from the shredder to said passage above the  
85 screen, a screw conveyor in said passage, means for rotating the conveyor to move shredded fruit from the lower portion of the passage to a discharge opening at the upper end thereof, a finisher communicating with  
90 the upper end of said passage, said finisher having an inlet for receiving shredded fruit from the passage and a discharge outlet, a source of heated water, and a liquid circuit including means for conducting a portion of  
95 the liquid passing through the screen to storage and the balance of liquid to the upper end of said passage, and means for mixing heated water with the liquid at said upper end of the passage.

12. A continuous method for preparing a flavour base of fruits substantially as hereinbefore described.

13. An apparatus for preparing flavour bases of fruits substantially as hereinbefore  
105 described with particular reference to the embodiment shown in the accompanying drawing.

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COMPLETE SPECIFICATION

1 SHEET

*This drawing is a reproduction of  
the Original on a reduced scale*

